

CLAIMS

1. A magnetic field sensor comprising:  
a first switch part which receives a signal  
corresponding to a signal of a magnetoelectric element  
in an applied magnetic field, and which outputs an  
output signal so that a polarity of the output signal  
in a first period and a fourth period are each  
opposite to a polarity of the output signal in a  
second period and a third period,

an amplifier which amplifies the output  
signal of the first switch part and outputs an output  
signal to its output terminal pair,

a first memory element of which both ends  
are connected to said output terminal pair of the  
amplifier,

a second switch part connected between one  
of said output terminal pair and one terminal of said  
first memory element, and which closes in  
synchronization to said first period and said third  
period and opens in synchronization to said second  
period and said fourth period, and

an output switch terminal which outputs a  
signal of a first polarity in the second period, and  
which outputs a signal of an opposite polarity to said  
first polarity in the fourth period.

2. A magnetic field sensor comprising:

a magnetoelectric element which has a first terminal pair and a second terminal pair and which outputs a signal corresponding to an applied magnetic field,

a first switch part which receives a signal of the first terminal pair and a signal of the second terminal pair of the magnetoelectric element and at least one external signal which determines a first period, a second period, a third period and a fourth period, and which outputs a signal of said first terminal pair of the magnetoelectric element in the first period and the fourth period, and outputs a signal of said second terminal pair of the magnetoelectric element in the second period and the third period,

an amplifier which amplifies the output signal of the first switch part and outputs a signal to its output terminal pair,

a first memory element of which both ends are connected to said output terminal pair of the amplifier,

a second switch part connected between one of said output terminal pair and one terminal of said first memory element, and which closes in synchronization to the first period and the third

period and opens in synchronization to the second period and to the fourth period, and

an output switch terminal which outputs at least one of the signals at the ends of said second switch part.

3. A magnetic field sensor in accordance with Claim 1 or 2, wherein said second switch part comprises an output terminal pair.

4. A magnetic field sensor in accordance with Claim 1 or 2, wherein the magnetic field sensor further comprises a comparator, which receives the signal of said output switch terminal, and outputs a result of comparison with a predetermined value.

5. A magnetic field sensor in accordance with Claim 4, wherein a different voltage is appended to the signal of said output switch terminal, corresponding to the output signal of said comparator.

6. A magnetic field sensor in accordance with Claim 1 or 2, wherein one end of said second switch part is connected to one of the input terminal pair of the comparator, and the other end of said second switch part is connected to the other said

input terminal pair of the comparator via a second memory element.

7. A magnetic field sensor in accordance with Claim 6, wherein the magnetic sensor further comprises

a third switch part, one end of which is connected to one end of said second memory element,

a fourth switch part, one end of which is connected to the other end of said second memory element,

a first voltage source which applies a first voltage to the other end of said third switch part, and

a second voltage source which applies a voltage different from said first voltage to the other end of said fourth switch part, wherein

said third switch part and the fourth switch part are closed in said first and fourth period.

8. A magnetic field sensor in accordance with Claim 7, wherein either one of said first voltage or said second voltage is changed corresponding to said external signal.

9. A magnetic field sensor in accordance

with Claim 1 or 2, wherein said first memory element is a capacitor.

10. A magnetic field sensor in accordance with Claim 7, wherein said second memory element is a capacitor.

11. A magnetic field sensor in accordance with Claim 1 or 2, further comprising a judgment circuit which receives a signal of said output switch terminal and outputs a signal of judgment result of the signal value of the second period and the fourth period.

12. A magnetic field sensor in accordance with Claim 11, wherein said judgment circuit comprises:

a first flip-flop circuit which receives the signal of said comparator output terminal at its D input terminal and receives a first clock signal at its clock input terminal, and which holds the signal in said second period and outputs the signal to its Q output terminal,

a NOR logic circuit which receives the output signal of said comparator terminal and the output signal of the Q output terminal of said first

flip-flop circuit at its input terminal pair respectively and outputs an NOR logic output, and a second flip-flop circuit which receives an output of said NOR logic circuit at its D input terminal and receives a second clock signal at its clock input terminal, and which holds the signal in said fourth period and outputs the signal to its output terminal, wherein

    said judgment circuit outputs a signal from the second flip-flop circuit output terminal.

13. A magnetic field sensor in accordance with Claim 11, wherein said judgment circuit comprises:

    a first flip-flop circuit which receives the signal of said comparator output terminal at its D input terminal and receives a first clock signal at its clock input terminal, and which holds the signal in said second period and outputs the signal to its Q output terminal,

    a second flip-flop circuit which receives the signal of said comparator output terminal at its D input terminal and receives a second clock signal at its clock input terminal, and which holds the signal in said fourth period and outputs the signal to its output terminal, and

a NOR logic circuit which receives the Q outputs of said first flip-flop circuit and said second flip-flop circuit at its input terminal pair respectively and outputs a NOR logic output, wherein said judgment circuit outputs the NOR logic output.

14. A magnetic field sensor in accordance with Claim 1 or 2, wherein said first switch part comprises

a first voltage terminal which outputs a first voltage,

a second voltage terminal which outputs a second voltage,

a first input terminal, a second input terminal, a third input terminal, and a fourth input terminal,

a first output terminal and a second output terminal,

a first switch element connected between the first voltage terminal and the first input terminal, and which performs an open/close operation corresponding to the external signal,

a second switch element connected between the first voltage terminal and the second input terminal, and which performs an open/close operation

corresponding to the external signal,

a third switch element connected between the second voltage terminal and the third input terminal, and which performs an open/close operation corresponding to the external signal,

a fourth switch element connected between the second voltage terminal and the fourth input terminal, and which performs an open/close operation corresponding to the external signal,

a fifth switch element connected between the first output terminal and the first input terminal, and which performs an open/close operation corresponding to the external signal,

a sixth switch element connected between the first output terminal and the second input terminal, and which performs an open/close operation corresponding to the external signal,

a seventh switch element connected between the second output terminal and the third input terminal, and which performs an open/close operation corresponding to the external signal, and

an eighth switch element connected between the second output terminal and the fourth input terminal, and which performs an open/close operation corresponding to the external signal, wherein

one end of said first terminal pair of the

magnetoelectric element is connected to said first input terminal,

one end of said second terminal pair of the magnetoelectric element is connected to said second input terminal,

the other end of said first terminal pair of the magnetoelectric element is connected to said third input terminal, and

the other end of said second terminal pair of the magnetoelectric element is connected to said fourth input terminal.

15. A magnetic field sensor in accordance with Claim 14, wherein said first, third, sixth and eighth switch elements close in the first period and the fourth period, while said second, fourth, fifth and seventh elements close during the second period and the third period.

16. A magnetic field sensor in accordance with Claim 1 or 2, wherein said magnetoelectric element is a Hall element.

17. A magnetic field sensor in accordance with Claim 1 or 2, wherein said magnetoelectric element is a magnetic resistance element.

18. A device for detecting a magnetic field comprising:

a first selecting-signal generator which generates a first selecting-signal during a first period and a fourth period,

a second selecting-signal generator which generates a second selecting-signal during a second period and a third period,

a third selecting-signal generator which generates a third selecting-signal during the first period and the third period,

a magnetoelectric element which has a first terminal pair and a second terminal pair and which outputs a signal corresponding to an applied magnetic field,

a first switch part which receives a signal of the first terminal pair and a signal of the second terminal pair of the magnetoelectric element, and said first selecting-signal and said second selecting-signal respectively, and which outputs a signal of said first terminal pair of the magnetoelectric element in the first period and the fourth period, and outputs a signal of said second terminal pair of the magnetoelectric element in the second period and the third period,

an amplifier which amplifies the output signal of the first switch part and outputs a signal to its output terminal pair,

a first memory element, both ends of which are connected to said output terminal pair of the amplifier,

a second switch part connected between one of said output terminal pair and one terminal of said first memory element, and which receives said third selecting signal, and which closes in the first period and the third period and opens in the second period and the fourth period,

a comparator which receives at least one of the voltages at the ends of said second switch part, and which outputs a result of comparison with a predetermined value, and

a judgment circuit which outputs a logical sum signal of the output signal of said comparator in the second period and the output signal of said comparator in the fourth period.

19. A method for detecting magnetic field comprising:

a step of receiving a signal corresponding to an applied magnetic field, outputted from a magnetoelectric element, and outputting an output

signal so that a polarity of the output signal in a first period and a fourth period opposites to a polarity of the signal during a second period and a third period,

an amplifying step of amplifying and outputting the output signal,

a holding step of holding the output signal outputted in said amplifying step in a first memory element, in the first period and the third period,

an addition step of adding-signal components of an output signal outputted in said amplifying step and the output signal stored in said first memory element, in the second period and the fourth period,

a comparison step of receiving the added signal components of said addition step in the second period and the fourth period, and outputting a result of comparison with a predetermined value, and

a judgment step of outputting a logical sum of the output signal of said comparison step in the second period and the period.

20. A magnetic field sensor in accordance with Claim 1 or 2, further comprising;

a signal generator which outputs a signal to said first switch part for determining said first, second, third and fourth period.